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EXHAUST EMISSIONS FROM A PASSENGER AUTOMOBILE EQUIPPED WITH ELECTRONIC FUEL INJECTION

John C. Thomson

National Air Pollution Control Administration
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16. Abstracts

The exhaust emission characteristics of a Ford Thunderbird equipped with electronic fuel injection were determined over a standard series of tests. The vehicle installation made by the Bendix Corporation consisted of a complete conversion to fuel injection. The vehicle used a standard Ford 429 cubic inch V-8 engine. The following tests were performed on this vehicle: (1) standard 1970 Federal test procedure for exhaust emission (FTP); (2) closed, constant volume sampling technique using 9 repeats of the Federal emissions test cycle (9 CVS); (3) closed, constant volume sampling technique using the LA4-S3 driving schedule proposed for 1972 and later testing (LA4); (4) acceleration tests consisting of wide open throttle accelerations (WOT) from 0-60 mph, 20-50 mph and 50-80 mph. Results indicate that this vehicle conversion resulted in a vehicle that would not meet the present or proposed emission standards. In addition the performance and driveability were adversely affected.

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Electronic Fuel Injection
1970 Federal Test Procedure (FTP)
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LA4-S3 Driving Schedule

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John C. Thomson
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ENVIRONMENTAL PROTECTION AGENCY

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Vehicle Tested

The exhaust emission characteristics of a Ford Thunderbird equipped with electronic fuel injection were determined over a standard series of tests. The vehicle installation was made by the Bendix Corporation and consisted of a complete conversion to fuel injection. The vehicle used a standard Ford 429 cubic inch V-8 engine with all normal accessories. The engine was tuned by Bendix to provide minimum exhaust emissions with little consideration toward driveability.

Tests Conducted

The following tests were performed on this vehicle:

1. Standard 1970 Federal test procedure for exhaust emission (FTP).

2. Closed, constant volume sampling technique using 9 repeats of the Federal emissions test cycle (9 CVS).

3. Closed, constant volume sampling technique using the LA4-S3 driving schedule proposed for 1972 and later testing (LA4).

Closed cycle data were taken using a constant volume sampling technique. Bag samples were analyzed using non-dispersive infrared analysis for carbon monoxide with hydrocarbons measured using flame ionization detector. Oxides of nitrogen are reported as measured with a modified Saltzman technique and the Whittaker NOx Box. Due to recent examination of equipment malfunctions the reliability of either NOx technique is in question.

In addition to the standard emission tests, some performance data was obtained. The acceleration tests consisted of wide open throttle accelerations (WOT) from 0-60 mph, 20-50 mph and 50-80 mph. A standard Thunderbird was used for comparison during this test.

Emission Results

Due to the wide variation in emission results obtained in the four tests run all of the results are presented in Table 1.. The wide variations are probably due to the driveability problems encountered during the tests. As can be seen from these results the vehicle failed to pass either the 1970 or the 1972 emission standards. The oxides of nitrogen are moderately low although still not below the 1975 proposed standard of 0.9 gpm. There is still room for considerable improvements in emission levels.

Acceleration Results

The acceleration tests were run over the same roads under similar conditions. Both vehicles had passenger loads of 350 pounds. The tests are an average of two runs in opposite directions. Table 2 shows the tests run and the results. The fuel injected vehicle was slightly faster on the 0-60 mph acceleration runs but on the other tests the standard vehicle was considerably faster. There was a very objectionable hesitation on tip-in and surging on cruise. Overall driveability was deemed commercially unacceptable.

Conclusions

This vehicle conversion resulted in a vehicle that would not meet the present or proposed emission standards. In addition the performance and driveability were adversely affected.

TABLE 1

Emission Results

	LA4*		9X7		FTP**	
	(all results in grams per mile)					
Hydrocarbons	10.8	5.4	4.3	5.7	2.3	2.3
Carbon Monoxide	50	40	34	60	21	22
Carbon Dioxide	916	899	746	748	---	---
Oxides of Nitrogen (Saltzman)	1.2	1.5	1.9	2.0	---	---
Oxides of Nitrogen (NOx Box)	3.1	2.5	2.3	2.4	---	---
Oxides of Nitrogen (Infrared)	----	---	---	---	1.6	1.5

* 1972 Emission Standards are HC = 3.4 gpm, CO = 39 gpm.
** 1970 Emission Standards are HC = 2.2 gpm, CO = 23 gpm.

TABLE 2

Acceleration Results

	Bendix T-Bird	Standard T-Bird
0-60 mph	10.6 sec.	10.8 sec.
20-50 mph	7.3 sec.	5.5 sec.
50-80 mph	13.0 sec.	9.0 sec.